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| EXAMINER |
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MALDONADO, JULIO J

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2823

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09/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|---------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/822,563 | Applicant(s) ACIKEL ET AL. | |
| | Examiner Julio J. Maldonado | Art Unit 2823 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 6/18/2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
4a) Of the above claim(s) 11, 12, 25 and 30 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 29 and 32-36 is/are allowed.
- 6) ☒ Claim(s) 1-10 and 13-24, 26-28 and 31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicants' addition of claims 32-36 as set forth in the reply filed 06/18/2007 is acknowledged.
2. Claims 1-36 are pending in the application, wherein claims 11, 12, 25 and 30 were previously withdrawn from consideration.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1, 10 and 22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1, 10 and 22 recite "...annealing the BST material to repair damage to the BST material without first producing an annealing layer in contact with the BST material.". Although there is support for forming a passivation layer before forming any other structure in the capacitor (Paragraph [0032] of the disclosed specification), and performing standard annealing after BST processing is completed (Paragraph [0032] of the disclosed specification), there is no support for "annealing the BST material to repair damage to the BST material without first producing an annealing layer in contact with the BST material" as claimed.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 10, 13, 14, 16-18, 20, 21 and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Sun et al. (U.S. 6,379,977 B1, hereinafter Sun).

Sun (Figs.1A-1E) teaches a method of forming a capacitor including the steps of forming a bottom electrode (15, 16) comprising platinum supported by a substrate (11) (Sun, column 2, lines 61 – 62); forming a BST thin film dielectric region (17a) over the bottom electrode (15, 16), including producing BST thin film material over the bottom electrode (15, 16) (Sun, column 3, lines 19 – 20); forming a top electrode (18a) comprising platinum over the BST thin film dielectric region (17a), including producing top electrode material over the BST thin film material immediately after producing the BST thin film material but before annealing the BST thin film material, wherein a lateral shape of the BST thin film dielectric region (17a) is formed only after producing the top electrode material (18a) over the BST thin film material (Sun, column 3, lines 19 – 31); after producing the top electrode material (18a), annealing the BST thin film material to repair damage to the BST thin film material without first producing an annealing layer in

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contact with the BST thin film material (Sun, column 3, lines 28 – 31); and forming a passivation structure (19, 20) made of silicon oxide (Sun, column 3, lines 41 – 48).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1-8, 22-24 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (U.S. 2004/0087082 A1) in view of Sun ('977).

In reference to claims 1, 22, 23, 28, Nakata (Figs.2A-2F) teaches a method of forming a MIM capacitor including the steps of forming a platinum bottom electrode (3) supported by a substrate (1), including forming a lateral shape of the bottom electrode; forming a silicon nitride thin film dielectric region (5) over the bottom electrode (3), including producing silicon nitride material over the bottom electrode (3) only after the lateral shape of the bottom electrode (3) is formed; and forming a top electrode (6) over the silicon nitride thin film dielectric region (5) (Nakata, [0018] – [0026]).

Nakata fails to disclose wherein the thin film dielectric region is made of BST, and after producing the top electrode material, annealing the BST material to repair damage to the BST material without first producing an annealing layer in contact with the BST material.

Sun (Figs.1A-1E) teaches a method of forming a capacitor including the steps of forming a bottom electrode (15, 16) comprising platinum supported by a substrate (11)

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(Sun, column 2, lines 61 – 62); forming a BST thin film dielectric region (17a) over the bottom electrode (15, 16), including producing BST thin film material over the bottom electrode (15, 16) (Sun, column 3, lines 19 – 20); forming a top electrode (18a) comprising platinum over the BST thin film dielectric region (17a), including producing top electrode material over the BST thin film material immediately after producing the BST thin film material but before annealing the BST thin film material, wherein a lateral shape of the BST thin film dielectric region (17a) is formed only after producing the top electrode material (18a) over the BST thin film material (Sun, column 3, lines 19 – 31); after producing the top electrode material (18a), annealing the BST thin film material to repair damage to the BST thin film material without first producing an annealing layer in contact with the BST thin film material (Sun, column 3, lines 28 – 31); and forming a passivation structure (20) made of silicon oxide (Sun, column 3, lines 41 – 48).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Nakata and Sun to enable forming the capacitor dielectric of Nakata using the materials according to the teachings of Sun because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of capacitor dielectric of Nakata and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to enable annealing the BST layer of the combination of Nakata and Sun for the further advantage of repairing any damage done to the capacitor during the etching process (column 3, lines 28 – 31).

In reference to claims 2, 4, 5, 24, the combined teachings of Nakata and Sun teach wherein the step of forming a bottom electrode supported by a substrate comprises forming a lift off mask over the substrate, the lift off mask defining the lateral shape of the bottom electrode; depositing a layer of bottom electrode material over the lift off mask; and removing the lift off mask, thereby forming the lateral shape of the bottom electrode (Nakata, [0018] – [0026]).

In reference to claims 3, 6-8, 26, 27, the combined teachings of Nakata and Sun teach wherein the step of forming a lift off mask over the substrate comprises depositing a photoresist lift off mask over the substrate; and the step of depositing a layer of bottom electrode material over the lift off mask comprises depositing a platinum layer and a gold layer over the photoresist lift off mask (Nakata, [0018] – [0026]).

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata ('082) in view of Sun ('977) as applied to claims 1-8, 22-24 and 26-28 above, and further in view of Nishioka et al. (U.S. 5,489,548, hereinafter Nishioka).

The combined teachings of Nakata and Sun substantially teach all aspects of the invention but fail to disclose wherein the bottom electrode consists essentially of a conductive oxide. However, Nishioka teach a method of forming a high dielectric constant capacitor including forming a bottom electrode, a BST dielectric region, and a top electrode, wherein said electrode are made from a group of material including platinum, gold and conductive oxides (Nishioka, column 9, lines 7 – 23).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Nakata and Sun with Nishioka to enable forming the bottom electrode

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of the combination of Nakata and Sun using the materials according to the teachings of Nishioka because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming the disclosed bottom electrode of Nakata and Sun and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

10. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sun ('977) as applied to claims 10, 13, 14, 16-18, 20, 21 and 31 above, and further in view of Moslehi (U.S. 5,273,609).

Sun substantially teaches all aspects of the invention but fails to disclose wherein the step of forming a layer of top electrode material over the BST thin film material comprises depositing a platinum layer over the BST thin film material, wherein deposition of the platinum layer occurs in a same processing chamber as production of the BST thin film material, and without interim removal of the BST parallel plate capacitor from the processing chamber. However, Moslehi teaches a deposition process, wherein said process is performed in a multi-step processing system and wherein multiple thin layers can be deposited in situ (Moslehi, column 7, line 60 – column 8, line 9).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sun with Moslehi to enable forming the layers of Sun in the processing system of Moslehi for the further advantage of reducing processing time (Moslehi, column 6, lines 36 – 47).

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11. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sun ('977) as applied to claims 10, 13, 14, 16-18, 20, 21 and 31 above, and further in view of Chiang et al. (U.S. 5,817,572, hereinafter Chiang).

Sun substantially teaches all aspects of the invention but fails to disclose wherein the passivation layer comprises silicon nitride.

However, Chiang (Fig.2) teaches a method of forming passivation layers (22), wherein said passivation layer is made from either silicon oxide or silicon nitride (Chiang, column 6, lines 48 – 53).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Sun and Chiang to enable forming the disclosed passivation layer of Sun using the materials according to the teachings of Chiang because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of forming the disclosed passivation layer of Sun and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Allowable Subject Matter

12. Claims 29 and 32-36 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fail to teach annealing the BST thin film dielectric region only after forming the passivation structure as disclosed in claim 29.

Response to Arguments

13. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

15. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

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16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

17. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.



Julio J. Maldonado
August 30, 2007

Julio J. Maldonado
Patent Examiner
Art Unit 2823



GEORGE R. FOURSON
PRIMARY EXAMINER